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NOTES ON THE COWRY, *CYPRAEA SPADICEA*, SWAINSON

BY WILLIAM MARCUS INGRAM

There has been very little published on the nut-brown cowry, *Cypraea spadicea* Swainson. The literature that is available is scattered and is almost entirely of systematic nature. The writer has collected members of this species for a number of years, and at this time is able to add to the literature already published, notes on the bulla stage, development of shell and color pattern, individual variations in size, and distributional range.

During the late summer of 1937 three individuals of *Cypraea spadicea* Swainson still in the bulla stage were collected alive clinging to the under surface of a stone in a tide pool at Laguna Beach, California. At the same time 2 smaller bulla stages were taken on the beach near the place of the first collection. The writer has not been able to find any descriptions of the bulla stage of this cowry in the literature, and believes that his are amongst the first to have been taken in the living state. The bulla stages that were collected are 19.5, 19, 19, 18, and 11 mm. in length, and are very similar to the corresponding stages of *Cypraea carneola* Linnaeus. A complete description of the bulla stage based on the 19 mm. individuals and numbered 4234 and 4235 in the writer's collection follows (Pl. 1, figs. 8-11).

Shell color creamy-brown; shell crossed by three brown bands extending from columella to outer lip, middle band 4 mm. in width, anterior and posterior bands 3 mm. in width; coloring of middle band most distinct; posterior band limited to the body whorl at the base of the spire; spiral whorls arise abruptly from body whorl, apex pointed; aperture 6 mm. broad at point of maximum width; columella creamy-white; external banding visible in cavity of the shell.

The shells that may represent the next stage in development from the bulla were also obtained alive in a tide pool at Laguna Beach, California, and are numbered 5453 and 2369 in the writer's collection. These shells are 42 and 46 mm. in length respectively. In these specimens the columellar teeth are just beginning to form and the outer lip of the younger bulla stage has turned ventrally and medially. There is no indication of the thickening of the basal margins of the shells. The three brown color bands over the dorsal surface of the shell still persist. The only indication of the brown blotch on the dorsal surface that is characteristic of the adult is represented by a band of deep brown color about 7 mm. broad on that part of the body whorl adjoining the spire. The spire is very prominent and in both specimens measures 5 mm. in height. The columellar and outer lips and lateral surfaces of the shells are just beginning to assume the white color that is characteristic of these regions in the adult (Plate 1, fig. 12).

Six other shells numbered in the writer's collection consecutively from 1452 to and including 1457 and also from Laguna Beach probably represent that stage in shell development immediately preceding the adult. These specimens measure from 39 to 52 mm. in length. The teeth on the outer and columellar lips are perfectly formed, and the two lips as well as the basal-lateral margins of the shells have thickened so that they are characteristically adult. The 3 brown color-bands over the dorsal surface of the shell still persist. The brown blotch of the typical adult is still confined to the body whorl adjoining the spire, and in the largest specimen is 10 mm. in width. The spire is still visible in one specimen, but cannot be seen in the others. One typical example of this stage is shown in Plate 1, figure 13.

It seems apparent that the last adult shell character to be formed by this mollusk is the brown-blotched color pattern of the dorsal surface. Other species of cowries that form the dorsal color pattern as the last of the adult shell characters are: *Cypraea ventriculus* Lamarek, *Cypraea cervus* Linnaeus, *Cypraea cervinetta* Kiener, and *Cypraea cribraria* Linnaeus. In the majority of the members of the family, however, the last adult shell character to be assumed is the thickening of the base and the lateral walls of the shell. A few of the many species that illustrate this point in

the development of color pattern and shell are: *Cypraea sulcidentata* Gray, *Cypraea reticulata* Martyn, *Cypraea intermedia* Gray, *Cypraea vitellus* Linnaeus, and *Cypraea arabica* Linnaeus.

There is a great variation in size shown by nature members of *Cypraea spadicea* Swainson. The shell size here is based on shell length, the measurements being made from the extremity of the anterior to the extremity of the posterior shell regions over the base. In computing the measurements listed here only fully mature shells were used. Of the 160 specimens the writer examined, the largest measured 61 mm. and the smallest 31 mm. in length. The shells from San Pedro, California, proved to have the largest average length. The 34 shells from this locality that were measured possessed an average length of 50.5 mm. The specimens collected at San Diego, California, had the smallest average shell length. These shells showed an average length of 35.5 mm. for the 24 individuals measured. The 40 shells from Laguna Beach, California, that were measured had an average length of 42.2 mm.

As well as the writer has been able to determine the reported range of *Cypraea spadicea* Swainson extends from Monterey Bay, California, the northernmost locality, to San Martin Island, Mexico. Mrs. C. H. Fackenthal, of Pacific Grove, California, collected the specimen on which the northern record is based.¹ Her specimen was taken alive on Chinatown Point, Monterey Bay, California. Mr. A. M. Strong reported this species as occurring at San Martin Island, Mexico.² The writer is of the opinion that the specimen collected by Mrs. Fackenthal was a stray, and that the general northern range limit of this species is Santa Barbara, California, since no other authentic live collections have been made north of this locality. Individuals are seemingly to be found in greater abundance at San Diego, Laguna Beach, and San Pedro, California, than at any other locality in the species' distributional range.

In the fossil state this species has been reported from the Pliocene, Pleistocene, and recent formations. Grant and Gale list it from the middle Pliocene of Holser Canyon in Los Angeles

¹ S. S. Berry, *Miscellaneous Notes on California Mollusks*, The Nautilus, Vol. XXII, pp. 37-41, 1908.

² A. M. Strong, *Marine Mollusca of San Martin Island, Mexico*, Proc. of Calif. Acad. of Sciences, 4th series, Vol. XXIII, No. 12, pp. 191-194, 1937.

County, California; from the Pleistocene of Santa Barbara Island, and upper San Pedro Series of Deadman Island at San Pedro, Los Angeles County, and from the recent Santa Barbara Island to Cedros Island, Lower California.³ Arnold lists *Cypraea spadicea* Swainson as occurring in the Pleistocene of Santa Barbara Island and from San Pedro⁴; and Gabb reports the species from the Post-Pleistocene of Santa Barbara Island.⁵

Cypraea spadicea Swainson

Cypraea spadicea Swainson, Phil. Mag., Vol. LXI, p. 376, 1823.

Cypraea spadicea Gray, Monograph, *Cypracidae*, Zool. Jour., Vol. I, p. 71, 1824.

Shell obovately oblong, somewhat pyriform, attenuated anteriorly; aperture varies in width at anterior extremity from 3 to 4 mm., and at posterior extremity from 3 to 5 mm.; teeth vary in width from .50 to 1 mm., teeth rounded on free edge and distinct, teeth spaced from each other on columellar and outer lips from .25 to 1 mm. apart, teeth on columellar lip restricted to aperture, teeth on outer lip extend approximately 1 mm. over the base; anterior and posterior canal extremities rounded, posterior outer lip canal extremity projects further from bulk of shell than the posterior columellar lip extremity, projections of anterior canal extremities may be equal, or if not, the anterior columellar lip extremity projects the further; shell color over the dorsal surface chestnut-brown, clouded toward the edges with burnt brown, edged with a confused row of dark brown spots, which in some shells are not distinguishable having blended together in growth to form a wavy dark brown line; sides of shell vary in color from smoky-grey to pinkish white, base of shell ivory-white; spire covered by last layer of enamel to be laid down on dorsal surface of shell, spire outline may or may not be seen under this enamel layer.

The above description is based on the results obtained from an examination of 72 shells, and represents a fairly complete account of the peculiarities that are characteristic of this species. The shells that were examined varied in length from 31 to 61 mm.

³ U. S. Grant and H. R. Gale, *Pliocene and Pleistocene Mollusca of California and Adjacent Regions*, Memoirs of San Diego Society of Natural Sciences, Vol. 1, 1931.

⁴ R. Arnold, *The Paleontology and Stratigraphy of the Marine Pliocene and Pleistocene of San Pedro, California*, Contributions from the Hopkins Seaside Laboratory of Leland Stanford Jr. University, XXXI, 1903.

⁵ W. M. Gabb, *Cretaceous and Tertiary Fossils*, Geological Survey of California, Paleontology, Vol. II, 1869.